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ENHANCING THE EFFICIENCY OF GOLD RECOVERY PROCESSES DURING THE PROCESSING OF PLACER DEPOSIT SANDS

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Abstract
This study investigates the distribution of gold particles in technogenic placer deposits and the associated losses during extraction processes. Gold is predominantly present in fine, dispersed, and submicron forms, making complete recovery through conventional gravity separation methods difficult. Consequently, a considerable amount of gold is lost during processing. The findings indicate that the application of surfactants and sorbents can significantly enhance the recovery efficiency of fine gold particles. In addition, chemical and nanochemical approaches are identified as promising directions for improving overall gold extraction performance.

Keywords: Technogenic placer deposits; gold; fine particles; gravity concentration; gold losses; surfactants; sorption; nanochemical methods.

Introduction

In technogenic placer deposits, gold predominantly occurs in fine, dispersed, and submicron forms. The particle size typically ranges from 1.0 μm to 0.5 mm, while the morphology varies from scaly and lamellar to dendritic and reticular structures. Due to these characteristics, such particles cannot be fully recovered using conventional gravity concentration methods, leading to significant gold losses during processing. Geological investigations show that fine and plate-like gold fractions account for the major portion of these losses. Therefore, in recent years, addressing this issue through the application of non-traditional and integrated processing technologies has become increasingly important.

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The research was carried out under conditions of placer deposits and industrial waste processing. It was established that gold losses during gravity concentration processes reach 25–37%, particularly in the fine fractions smaller than 0.25 mm. The influencing factors contributing to these losses, along with their possible solutions, have been identified and are presented in Table 1.

Table 1 Factors Influencing Gold Losses and Strategies for Their Reduction

№	Factors affecting gold loss	Solutions for Loss Reduction
1	Presence of heavy associated minerals (magnetite, ilmenite, cassiterite, etc.)	Use of magnetic and electromagnetic separators
2	Design limitations of sluice gates and flushing devices	Use of surfactants
3	Water flow velocity and density	Sorption-based nanochemical methods
4	Particle buoyancy	Chlorination and other dissolution methods

The results show that surfactants and sorbents enhance the precipitation of fine gold particles, thereby improving their effective separation. It has been confirmed that finely dispersed gold particles can be recovered only through chemical methods, including dissolution and sorption processes. The conducted analyses indicate that gold losses in technogenic placer deposits are mainly associated with fine dispersed and submicron particles. Conventional gravity concentration methods are insufficient to ensure complete recovery of these fractions. Therefore, a comprehensive approach is required to improve extraction efficiency, which includes the measures presented in Table 2.

Table 2 Main technological directions for reducing gold losses

№	Direction	Summary
1	Optimization of hydrodynamic conditions	Improving the precipitation of gold particles by controlling the velocity and density of the slurry flow
2	Reducing the impact of associated minerals	Reducing the negative impact of heavy minerals (magnetite, ilmenite, etc.)
3	Application of reagents and surfactants	Improving particle wetting and increasing the efficiency of fine gold extraction
4	Implementation of sorption and nanochemical technologies	Absorption of gold from solution using sorbents and separation by nanochemical methods

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Non-traditional technologies represent one of the most promising approaches for addressing the challenges associated with the extraction of gold particles at micron and submicron sizes.

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